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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/607,838	06/27/2003	Kanakasabapathi Subramanian	1153.071US1	8463
21186	7590	07/27/2005	EXAMINER	
SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A. P.O. BOX 2938 MINNEAPOLIS, MN 55402-0938			SARKAR, ASOK K	
			ART UNIT	PAPER NUMBER
			2891	

DATE MAILED: 07/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/607,838	SUBRAMANIAN ET AL.	
	Examiner	Art Unit	
	Asok K. Sarkar	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 May 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 and 9-29 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 16-29 is/are rejected.
- 7) ☒ Claim(s) 10-15 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claims 1, 9, 10, 17 and 21 are objected to because of the following informalities:

The phrase "oxidizing the wafer" lacks an antecedent basis for the word "wafer".

Appropriate correction is required.

Claims 19 and 20 are objected to because of the following informalities:

The word "lines" lacks an antecedent basis.

Claim 24 is objected to because of the following informalities:

In line 5, following the word "until", the word "lines" lacks an antecedent basis.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1 – 6, 9, 17, 19, 21 and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by MacDonald, US 5,628,917.

Regarding claim 1, MacDonald teaches a method of forming structures in a semiconductor substrate, the method comprising:

- forming lines of different widths having a first floor (see Fig. 1h);
- oxidizing the wafer until lines of thinner width are substantially fully oxidized (see Fig. 1i);

Art Unit: 2891

- etching the oxide to expose the first floor (see Fig. 1j); and
- etching the exposed first floor deeper into the substrate to form a second floor (see Fig. 1k) in column 5, lines 20 – 36.

Regarding claim 2, MacDonald teaches removing the oxide from the lines in column 5, lines 48 – 49.

Regarding claim 3, MacDonald teaches removing the oxide using anisotropic etching in column 5, lines 57 – 60.

Regarding claim 4, MacDonald teaches etching the oxide by CHF_3 anisotropic RIE in column 5, line 40 and in line 57.

Regarding claim 5, MacDonald teaches single crystal silicon substrate in column 5, line 20.

Regarding claim 6, MacDonald teaches deep RIE to etch the first floor with reference to Fig. 1K in 5, lines 65 – 67.

Regarding claim 9, MacDonald teaches thermal oxidation in column 5, lines 25 – 27.

Regarding claims 16, 17, 21 and 24, MacDonald teaches a method of forming a microstructure comprising:

- lithographically forming a pattern having structures of different widths, the structures extending up from a first floor of the substrate with reference to Figs. 1a – 1h in column 5, lines 17 – 36;

- oxidizing the structures on the substrate until lines of structures of a selected width (thin width) are substantially fully oxidized with reference to Fig. 1i in column 5, lines 52 - 57;
- CHF₃ reactive ion etching the oxide to expose the first floor with reference to Fig. 1j; and
- selectively etching the first floor deeper into the substrate to form a second floor with reference to Fig. 1k in column 5, lines 65 – 67 and releasing the structure with reference to Fig. 1n to form the suspended structure.

Regarding claim 19, MacDonald teaches forming contacts to the respective pillars in column 1, lines 27 – 30.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Art Unit: 2891

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 18, 20, 22, 23 and 25 – 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over MacDonald, US 5,628,917 in view of Hoffman, US 2004/0067346.

Regarding claim 18, MacDonald fails to teach the method further comprising removing the oxide and repeating oxidizing, etching and etching to form a further level of the multiple level structure.

Hoffman teaches method of forming multilevel structure by the process of removing the oxide and repeating oxidizing, etching and etching to form a further level of the multiple level structure in paragraphs 68 – 71 with reference to Figs. 4 and 5 for the benefit of facilitating the fabrication of large arrays in paragraph 5.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify MacDonald and add the process of removing the oxide and repeating oxidizing, etching and etching to form a further level of the multiple level structure for the benefit of facilitating the fabrication of large arrays as taught by Hoffman in paragraph 5.

Regarding claim 20, MacDonald fails to teach the gap between the pillars within 0.3 – 10 microns.

Hoffman teaches comb filters with gaps of 0.3 – 10 microns in paragraphs 104 – 106 for the benefit of facilitating the fabrication of large arrays in paragraph 5.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify MacDonald and have the gap between the pillars within 0.3 – 10 microns for the benefit of facilitating the fabrication of large arrays as taught by Hoffman in paragraph 5.

Regarding claims 22 and 23, MacDonald fails to teach releasing the lines by etching the substrate in all directions with SF₆ RIE.

Hoffman teaches isotropic RIE etch with SF₆ in paragraph 69 for the benefit of facilitating the fabrication of large arrays in paragraph 5.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify MacDonald and use isotropic RIE etch with SF₆ in for the benefit of facilitating the fabrication of large arrays as taught by Hoffman in paragraph 5.

Regarding claims 25 – 29, MacDonald in view of Hoffman teaches these limitations as was described earlier in rejecting claims 18, 22 and 23.

Allowable Subject Matter

8. Claims 10 – 15 are objected to as being dependent upon an objected base claim, but would be allowable if claim 10 is rewritten in corrected independent form including all of the limitations of the base claim and any intervening claims.

Art Unit: 2891

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is 571 272 1970. The examiner can normally be reached on Monday - Friday (8 AM- 5 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William B. Baumeister can be reached on 571 272 1722. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

10. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Asok Kumar Sarkar

Asok K. Sarkar
July 25, 2005

Primary Examiner